

Project Category: Coastal/Marine

Project Title: Effects of sea-level rise on salt marshes along the Pacific coast gradient: evaluation of methodology for resource managers

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Project Summary: Our goal is to apply sea-level rise (SLR) modeling approaches along the Pacific coast tidal gradient (Fig. 1) at a parcel scale through improved data collection tools and collaboration relevant to land managers. At selected salt marsh parcels in both the North Pacific and California LCCs, we will employ our data collection techniques for assessing detailed baseline habitat elevations; tidal ranges, microclimate, and extreme weather events; sediment supply sources; vegetation community composition; and vertebrate population indices. Our design will include providing resource managers with information on the value of different datasets and methods including their uncertainty, as well as determining their usefulness in climate change adaptation planning in tidal marsh habitats.

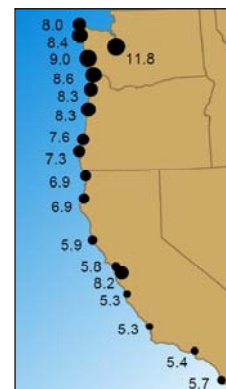


Figure 1. Variation (ft) in Pacific coast tidal range.

Project Proposal:

Background and Need: Coastal areas are high risk zones to impacts of global climate change. Projected sea-level rise (SLR) up to 1.9 m by 2100 is expected to alter coastal estuaries (IPCC 2007, Jevrejeva *et al.* 2008, Vermeer and Rahmstorf 2009) resulting in loss of tidal salt marshes and their associated species (Takekawa *et al.* 2006). The effects of SLR on estuaries of the Pacific coast will be unique with influences of snowmelt runoff from western mountain ranges and a large tidal range. Storm events will be a major driver of SLR effects in the North Pacific, and parcel-level data collection will more-effectively address their effects. Tidal marshes are recognized as highly-threatened habitats that require special management plans -- these include Refuge Comprehensive Conservation Plans which must include climate change effects such as SLR. Climate change concerns are related to fragmentation of wetland habitats and land use pressures. Availability of undeveloped lands surrounding existing salt marshes is limited, and thus, many marshes will not be able to move upslope to accommodate rising SLR.

Loss of salt marsh habitats along the Pacific coast tidal gradient will impact demographic and community structure of these sensitive communities, and targeted restoration and triage will be required to save remnant areas. However, rather than working with downscaled global climate models that are

difficult to interpret at a particular site, our approach is working with local managers and communities to assess parcel-scale information from the bottom-up.

Our project goal is to apply SLR modeling at a parcel scale relevant to land managers through improved data collection tools and collaboration along the Pacific coast tidal gradient (Fig. 1). Our design will include providing resource managers with information on the value of different datasets and methods, as well as determining their usefulness in climate change adaptation planning in tidal marsh habitats. At 4-6 selected salt marsh parcels on refuges in the North Pacific LCC and complementary areas in the California LCC, we will undertake collection techniques we developed for assessing detailed habitat elevations; tidal ranges, microclimate, and extreme weather events; sediment supply sources; vegetation community composition; and vertebrate population indices. We will compare existing datasets such as LiDAR and vegetation samples to these methods and compare their value in understanding SLR vulnerability of tidal marshes.

The synthesis of these data sets and projections of ecosystem response to SLR will be developed in coordination with parallel work proposed to the NOAA National Estuarine Research Reserves (NERR) collaborative science program to develop structured decision-making (SDM) tools (Runge et al. 2009) for Pacific coast estuaries. Deliverables will include highly accurate 3-D digital elevation geospatial maps for each site; annual water inundation patterns recording extreme events and area microclimate; evaluation of available sediment; detailed maps of the vegetation community structure and indices of vertebrate populations; and projections of SLR impacts through SLR model Program WARMER (Wetland Accretion Model for Ecosystem Resilience, K. Swanson, unpubl. data). Development of these techniques will demonstrate initial costs and effort for long-term monitoring programs to evaluate ecosystem changes under future SLR. Partnerships will leverage USGS climate change funds, FWS R8 I&M support, North Pacific LCC and R1 I&M support, and UC Davis spatial imagery.

Objective: Our motivation for undertaking this work is the difficulty in applying existing climate change science to on-the-ground conservation and adaptation. Applying a bottom-up, parcel-based approach will provide concrete information for land managers attempting to develop adaptation plans for SLR impacts. Current methods (eg. LiDAR) and models (Sea Level Affecting Marshes Model or SLAMM; see Craft et al. 2009a,b; Kirwan and Guntenspergen 2009) often do not include assessment of errors or uncertainty that are critical to understand community response. A focus of our work is increasing accuracy of elevation and inundation modeling to appropriately address changes in vegetation and vertebrate communities found in tidal marshes.

Our approach integrates biophysical data obtained through relatively simple data collection methods including detailed elevations, tidal inundation, sediment supply, vegetation structure, and vertebrate response. These datasets provide a comprehensive understanding of current conditions in tidal marshes that span the geographic extent of the NPLCC and allow for future projections. Detailed coverages will be provided to land managers, while assessment of tools and reports will be provided online in cooperation with the FWS R1 I&M. These data will be used as the basis of discussions under proposed NERR collaborative workshops including both managers and stakeholders. Our project is focused on developing easily-used tools directly comparable across sites along the Pacific tidal gradient in both the California and North Pacific LCC. Our multi-disciplinary partnership includes USGS and university scientists of different specialties, land managers from Pacific coast refuges, USGS National Climate Change and Wildlife Science Center funds and equipment, monetary support from the FWS R8 I&M, and proposed support from the R1 I&M, North Pacific LCC, and NOAA NERR science collaborative science program. This proposal directly addresses methods to assess SLR impacts at a parcel scale. It is urgently needed to provide science support for adaptation plans that currently lack detailed background information.

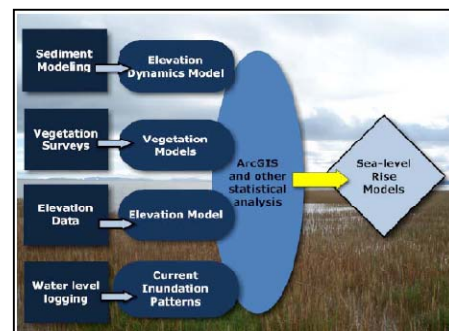


Figure 2. Parcel-based model to examine sea-level rise effects on tidal salt marsh habitats

Climate change scenarios typically address top-down global to continental scale changes; thus, few are easily interpretable or contain a vertical resolution that is useful at the local level for planning adaptation. Our studies are directed at a bottom-up approach to evaluating SLR effects at the parcel scale (however relevant at a landscape scale), providing information and databases useful in assessing local responses (Fig. 2). We will evaluate the availability of and develop the following datasets required for a comprehensive assessment of SLR impacts to tidal and sub-tidal marsh habitats: detailed elevation and plant community surveys, sediment availability and deposition assessments, tidal range and extreme climate event profiling (including local climatic condition monitoring), and wildlife habitats. The following methodology has been developed by the USGS under a grant from the National Climate Change and Wildlife Science Center at 12 salt marsh sites in San Francisco Bay estuary. Products and SOPs will be made available online in partnership with FWS R1 I&M and will be presented to local land managers. In addition, results will be shared with the North Pacific LCCs and FWS R1 I&M group.

Methods: Our project has been endorsed by refuge managers in the North Pacific LCC (Humboldt, Oregon Coast, Willapa, Nisqually) and in the California LCC (San Diego, San Francisco) to participate in this study, as well as managers for the 5 NOAA NERR sites (Tijuana River, Elkhorn Slough, San Francisco, South Slough, Padilla Bay). The field work and methods assessments will be conducted in cooperation with FWS Inventory and Monitoring Programs from R1 and R8 (in-kind support for equipment, \$20K).

(1) Elevation: develop high-resolution digital elevation

models (DEMs). A high-resolution vertical and horizontal DEM is needed to evaluate current and future inundation patterns. We developed a survey methodology (Fig. 3) to produce high resolution elevation models using a Real Time Kinetics GPS (RTK Smart Pole, Leica Systems, +/- 3 cm vertical accuracy). DEMs will be created from the surveys and cross-validated for each site. Parcel surveys with RTK GPS will be supplemented with available LiDAR or remote-sensing imagery of subtidal and upland transitions.

(2) Tidal range and extreme events: monitor water levels and tidal cycles to assess parcel level inundation patterns and extreme water events. To understand current tidal flooding patterns and cycles at local scale, we will deploy water-level loggers, placed in channel networks. The water-level monitoring provides detailed information on salt marsh flooding and drainage patterns including depth during tidal cycles, inundation periods of the marsh plain, and characteristics of flooding during storm events. Collection of microclimate data will be obtained from local weather stations to incorporate into inundation models.

(3) Sediment: evaluate sediment and organic matter processes to model salt marsh persistence through time. We are currently developing a vertical model (Fig. 4) that incorporates biological and physical components of marsh accretion processes and incorporates inorganic and organic deposition to compare with projected sea-level rise. We will apply the model (Callaway et al. 1996) including components of inorganic sediment deposition, organic matter production, decomposition, and compaction (WARMER; K. Swanson et al., unpubl. data). Data collection will include existing suspended sediment concentration data, benthic cores, bottle traps, and optical backscatter meters.

(4) Vegetation: inventory vegetation species composition and relationship to elevation and tidal ranges. We will conduct vegetation surveys (including invasive species) at elevation survey

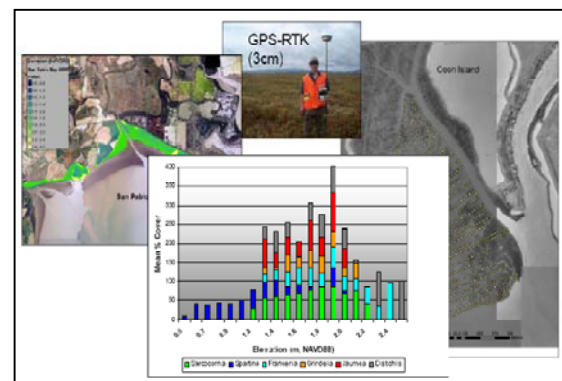


Figure 3. Elevation and vegetation coverage created from RTK GPS surveys

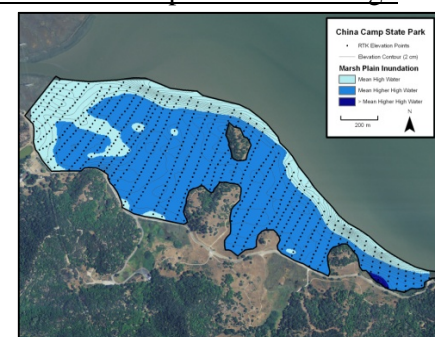


Figure 4. Preliminary WARMER sediment model incorporating organic and mineral sources (K. Swanson, unpubl. data).

points to examine habitat structure. A relationship between plant distribution and tidal datum will be developed integrating DEMs with habitat characteristics. We will assess the temporal and spatial availability of habitats under current tidal inundation (Fig. 5) as well as under future extreme tide levels and varying SLR scenarios. Plant species composition and structural relationship to tidal range directly impacts tidal marsh vertebrate species' vulnerability and risk to predation and reproductive failure.

(5) Wildlife: determine and quantify wildlife species and their habitats at local and regional landscape scale. Wildlife may be the most sensitive indicators of SLR effects. We will evaluate pre-existing wildlife surveys to unify definitions of acceptable biological response metrics to changing habitats and landscapes. Species presence and abundance is the most common metric used to determine habitat quality. We will identify with managers wildlife species of concern and identify key ecosystem structure, function and survey to evaluate those species impacts.

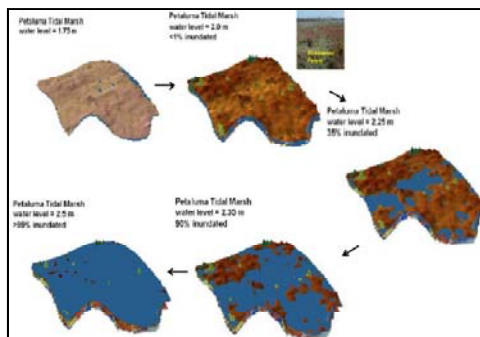


Figure 5. Changes in tidal marsh inundation and habitat availability with current and project sea-level rise

Geographic Extent: This project will span the entire Pacific coast tidal gradient to compare and contrast differences in SLR management challenges along the entire range. The NPLCC proposal will include areas from northern California (Humboldt NWR), coastal Oregon (Bandon NWR) and Washington (Willapa NWR) to Puget Sound (Nisqually NWR, Padilla Bay NERR), complementing existing proposals including the California LCC (San Diego NWRs, San Francisco NWRs) and 4 other NOAA NERRS (Tijuana River, Elkhorn Slough, San Francisco Bay, South Slough).

Timeline of Schedules, Products and Outcomes: The timeline indicates duration (quarters) from initial project contracting. Products for each site will include: (1) detailed high resolution DEMs (2) inundation patterns, microclimate weather data and sediment supply summaries and estimates; (3) vegetation and vertebrate indices for tidal marsh habitats; and (4) models of SLR inundation patterns. Products for each parcel will include inventory of currently available data that will be compared to collected datasets. ArcGIS models, products, summary reports and SOPs will be made available online in partnership with FWS I&M. Quarterly update will be provided by email for project partners including FWS I&M, area managers, and the NPLCC. These data will be used to populate SDM processes supported under the NOAA NERR collaborative science program.

	Year 1					Year 2	
Description	Q1	Q2	Q3	Q4		Q1	Q2
Map elevations and create DEMs	XX	XX	XX	XX			
Plant community analyses and elevation	XX	XX	XX	XX			
Tidal range inundation dataset		XX	XX	XX		XX	
Sediment availability assessment analysis		XX	XX	XX		XX	
Wildlife Indices			XX	XX		XX	
Data synthesis				XX		XXX	XXX
Summary Report and Collaborative Findings							XXX

Disclaimer regarding Data Sharing: Datasets including coverages will be fully available to all of the project partners and will be included on webpages (eg. www.nisquallydeltarestoration.org) and reports. The lead investigators retain the right to lead scientific publications from the datasets obtained in this study and to require permission for any other scientific publications.

Literature Cited:

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- Craft, C., J. Clough, J. Ehman, S. Joye, R. Parks, S. Pennings, H. Guo, and M. Machmuller. 2009. Forecasting the effects of accelerated sea-level rise on tidal marsh ecosystem services. *Front Ecol Environ* 7: 73–78.
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Budget:

North Pacific Landscape Conservation Cooperative 2011 Proposal Budget				
Budget Categories	NPLCC Request	Partner(s) Contribution(s) (monetary)	Partner(s) Contribution(s) (non-monetary value/in-kind)	Total
Salaries	\$ 67,105.00	\$ -	\$ 37,259.00	\$ 104,364.00
Supplies	\$ 2,124.00	\$ -	\$ 3,800.00	\$ 5,924.00
Overhead ^a	\$ 17,791.00	\$ -	\$ -	\$ 17,791.00
Equipment	\$ 2,140.00	\$ 20,000.00	\$ 50,000.00	\$ 72,140.00
Other (specify)	\$ 9,500.00	\$ -	\$ 15,000.00	\$ 24,500.00
Total	\$ 98,660.00	\$ 20,000.00	\$ 106,059.00	\$ 224,719.00
a = Indirect cost calculated at DOI client 22% for FY11				
Other:				
Project requests \$9,500 for travel to partner meetings and research sites. In-kind contribution of \$15,000 representing specialized equipment trainings, data collection, analysis, and synthesis during development of survey protocols and methodologies.				

Cost Leveraging: USGS will provide matching support towards salary, supplies and equipment, and methodological development for this collaborative Pacific coast research program that makes use of several funding sources. Partner contributions include support from the 3-year multi-disciplinary USGS National Climate Change and Wildlife Science Center grant (ending FY11) on San Francisco Bay tidal marshes representing \$37,259 in salaries for program development, \$3,800 in RTK-GPS subscription and services, \$50,000 in RTK-GPS equipment, and \$15,000 in specialized equipment training, data collection, analysis and synthesis during technique development. USFWS Inventory and Monitoring Region 8 agreed to provide \$20,000 in direct monetary contributions for equipment. A proposal to the California LCC (\$95K) would support similar work on southern refuges, and a proposal to the NOAA National Estuarine Research Reserve Science Collaborative (\$782K) would support addition of five NERR sites on the Pacific coast as well as community workshops to develop adaptation plans from these datasets within a structured-decision making framework. Finally, we have agreed to collaborate on common data needs, shared collection, and collaboration with a complementary NPLCC proposal being submitted for an overlapping site in Oregon by D. Reusser, USGS WFRS entitled "Site-scale modeling for sea-level rise effects on coastal habitats in the Pacific Northwest."

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(A) PROFESSIONAL PREPARATION

University of Washington, Seattle, WA, USA	Wildlife Science	B.Sc.	1975-1979
University of Idaho, Moscow, ID, USA	Wildlife Ecology	M.Sc.	1979-1982
Iowa State University, Ames, IA, USA	Animal Ecology	Ph.D.	1982-1987

(B) APPOINTMENTS:

1995-present Research Biologist, San Francisco Bay Estuary Field Station, USGS Western Ecological Research Center (WERC), Vallejo, CA
1986-1995 Research Biologist, USGS WERC, Dixon Field Station, Dixon, CA

(C) RELEVANT EXPERIENCE: I established the SFBE field station in 1995 to conduct research on waterbirds and their habitats. Our studies have shown that tidal flats are critical habitats for many migratory bird species, yet there are few studies on the importance of tidal flats or on their ecological function supporting foraging resources for waterbirds. Restoration of bayland habitats may result in changes in sensitive adjacent tidal flat foraging habitats, and the effects of such change are largely unknown. Thus, we have been focusing our research on the relationship of migratory birds to their estuarine habitats and better understand how these resources provide support for wintering and migrating populations. Climate change is expected to have major effects on western estuaries as changes in snowpack and sea level rise alter current hydrology and sediment processes. Our project will use existing data to model changes in tidal flats, and we will extend those models to predict likely effects on migratory birds. We are working with scientists in the CASCaDE project (Computational Assessments of Scenarios of Change for the Delta Ecosystem) that will provide supporting climate change modeling on the estuary.

(D) PUBLICATIONS: (Out of 140+ peer-reviewed journal publications and book chapters)

Takekawa, J. Y., A. K. Miles, D. H. Schoellhamer, D. C. Tsao-Melcer, S. Fregien, and N. D. Athearn. 2009. Dietary flexibility in three representative waterbirds across salinity and depth gradients in salt ponds of San Francisco Bay. *Hydrobiologia* 626:155-168.

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Poulton, V.K., J. R. Lovvorn, and J. Y. Takekawa. 2004. Spatial and overwintering changes in clam populations of San Pablo Bay, a semiarid estuary with highly variable freshwater inflow. *Estuarine, Coastal, and Shelf Science*, 59: 459-473.

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(A) PROFESSIONAL PREPARATION

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Ph.D., Candidate, Geography, University of California, Davis

(B) APPOINTMENTS

2011-present Coastal Technical Team member, The National Fish, Wildlife, Plants, Climate Adaptation Strategy Team
2005-present Biologist, USGS Western, Ecological Research Center (WERC), Vallejo, CA
2002-2005 Fisheries Biologist, U.S. Fish & Wildlife Service, Fairbanks, AK
2000-2002 Endangered Species Biologist, Jones & Stokes Associates, Sacramento, CA

(C) RELEVANT EXPERIENCE

My masters from the University of California, Davis, in geography were focused on environmental global change and remote sensing techniques. My current dissertation research focuses on an interdisciplinary approach of combining field ecology techniques with climate change adaptation questions. I currently work with Dr. Deborah Elliott-Fisk and Dr. Susan Ustin at UC Davis in developing new approaches to synthesize traditional field data, remote sensing, and climate change information to assess landscape level change from global climate change and how it relates to wildlife habitat.

I currently lead the climate change program at the USGS San Francisco Bay Estuary Field Station where we are evaluating the impacts from projected sea-level rise on salt marsh habitats and endangered species. Current research focuses are: *Landscape level scale of salt marsh impacts from sea-level rise* at 13 salt marsh site around the San Francisco Bay area, including elevation, tidal datum, and vegetation distributions at each marsh; *Modeling inundation patterns* for salt marsh habitats; *High tide predation surveys*: Field data collection of avian predator activity during high tide events. This is used to evaluate risk to endangered salt marsh species during high water events as analogs of future sea levels; and *Evaluate the applicability of Remote Sensing techniques for sea-level rise modeling*.

(D) RELEVANT PRODUCTS

Thorne, K.M., J.Y. Takekawa, and D. Elliott-Fisk. *Submitted*. Ecological effects of climate change on salt marsh vertebrates: a case study from a highly urbanized estuary. *Journal of Coastal Research*.
Thorne, K.M., D. Elliott-Fisk, J.Y. Takekawa, G. Wylie, and W. Perry. *In prep*. Landscape level approach to evaluating subsidence and accretion rates of a salt marsh. *Geomorphology*.
Thorne, K.M., J.Y. Takekawa, K. Spragens, and D. Elliott-Fisk. *In prep*. A case study of the impacts from contemporary sea-level rise on the San Pablo Bay National Wildlife Refuge, CA. *Journal of Wildlife Management*.
Thorne, K.M., S. Ustin, and J.Y. Takekawa. *In prep*. Application of aerial LiDAR in sea-level rise evaluations of salt marsh ecosystems. *Journal of Remote Sensing of the Environment*.
Takekawa, J.Y., K. M. Thorne, K. Spragens, C. Overton, and M. Cassazza. *In prep*. Landscape level effects of sea-level rise on salt marsh habitats of the greater San Francisco Bay. *Diversity and Distributions*.

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(A) PROFESSIONAL PREPARATION

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(B) APPOINTMENTS

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2001-2005 Associate Director California Space Institute (CalSpace) UC San Diego
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1995-2001 Associate Director, DOE's WESTGEC Program, UC Davis
1991-1999 Assistant & Associate Professor of Resource Science, Dept. of L.A.W.R., U.C., Davis, CA 95616
1990-1991 Assistant Research Resource Scientist, Dept. of L.A.W.R., U.C., Davis, CA 95616

(C) Relevant Experience (collaborators and coauthors):

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(D) PUBLICATIONS (OF 187 REVIEWED PUBLICATIONS AND 121 SCIENTIFIC PROCEEDINGS)

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(A) PROFESSIONAL PREPARATION

University of Wisconsin, Madison. M. S. Botany, Wetland Restoration emphasis. 2000
University of California, Berkeley. B. A. Integrative Biology, minor in Forestry. 1997

(B) APPOINTMENTS

2003 – current. Wetland Restoration Lead. USGS. WERC, Vallejo CA
2001 – 2003. Wetland Restoration Coordinator. Humboldt State University Foundation and USGS. WERC, Vallejo CA

(C) EXPERIENCE-- Mrs. Woo has 10 years of professional wetland research and monitoring experience as the Wetland Restoration program lead for the San Francisco Bay Estuary Field Station. The wetland restoration program focuses on applied science and monitoring to inform land managers and topics are far-ranging such as: monitoring the effectiveness of large scale estuarine restorations, design experiments to test restoration hypotheses, integration of science in restoration monitoring plans, methods development to measure rapidly changing restoring wetlands, tidal marsh vegetation, inundation and salinity effects on tidal marsh vegetation, meHg in tidal marsh foodwebs, recovery of tidal marsh vegetation after varying levels of all-terrain vehicle impacts, long term datasets and monitoring for endangered tidal marsh species, and prey availability studies within San Francisco Bay estuary and Southern Puget Sound. Mrs. Woo also understands the complexities of collaborations and has built and maintained strong partnership with fellow research scientists as well as Tribal, federal, state, and local managers and stakeholders. Mrs. Woo has authored or co-authored over 75 reports and presentations.

(D) SELECT PUBLICATIONS

- Woo, I.** and J. Y. Takekawa. In revision. Effects of inundation period and salinity on growth of *Sarcocoria pacifica* (common pickleweed): implications for future sea level rise scenarios and tidal marsh restoration. Wetlands.
- Takekawa, J. Y., **I. Woo**, N. D. Athearn, S. Demers, R. J. Gardiner, W. M. Perry, N. K. Ganju, G. G. Shellenbarger, and D. H. Schoellhamer. 2010. Measuring sediment accretion in early tidal marsh restoration. Wetlands Ecology and Management 18: 297-305.
- Woo, I.**, R. Storesund, J. Y. Takekawa, R. J. Gardiner, and S. Ehret. 2009. Integrating Terrestrial LiDAR and Stereo Photogrammetry to Map the Tolay Lakebed in Northern San Francisco Bay [in] Webb and Semmens, eds., Planning for an uncertain future—Monitoring, integration, and adaptation. Proceedings of the Third Interagency Conference on Research in the Watersheds: U.S. Geological Survey Scientific Investigations Report 2009-5049, p. 279-284.
- Tsao, D., J. Y. Takekawa, **I. Woo**, J. Yee, and J. Evens. 2009. Home range, habitat selection and movements of California Black Rails at tidal marshes at San Francisco Bay, California. The Condor 111(4): 599-610
- Tsao, D., K. Miles, J. Y. Takekawa, and **I. Woo**. 2008. Potential effects of mercury on threatened California black rails. Archives of Environmental Contamination and Toxicology Online First 10.1007/s00244-008-9188-4
- Takekawa, J. Y., **I. Woo**, H. Spautz, N. Nur, J. L. Grenier, K. Malamud-Roam, J. C. Norby, A. Cohen, F. Malamud-Roam, S. E. Wainwright-DeLa Cruz. 2006. Environmental threats to tidal marsh vertebrates of the San Francisco Bay Estuary. Studies in Avian Biology.
- Takekawa, J. Y., B. Sacks, **I. Woo**, M. B. Johnson, and G. D. Wylie. 2006. Effects of Tidal Marsh Fragmentation on Survival of San Pablo Song Sparrows in the San Francisco Bay Estuary. Studies in Avian Biology.
- Woo, I.**, T. Drlik, L. Swaidon, and W. Quarles. 2002. Integrated management of Knapweed. The IPM Practitioner. 24(4).
- Woo, I.** and J. B. Zedler. 2002. Can nutrients alone shift a sedge meadow towards the invasive *Typha x glauca*? Wetlands. 22:509-521.
- Zedler, J. B., R. Lindig-Cisneros, C. Bonilla-Warford, and **I. Woo**. 2001. Restoration of biodiversity: An overview. Pp. 203-212 in S. Levin, editor. Encyclopedia of Biodiversity, Vol. 5. Academic Press, San Diego.

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(A) Education

Ph.D., 2011 Civil and Environmental Engineering, University of California, Berkeley, Berkeley, CA

M.S., 2003 Civil and Environmental Engineering, University of California, Berkeley, Berkeley, CA

B.S.E. 2002 Civil and Environmental Engineering, Duke University, Durham, NC

(B) Relevant Experience

Hydrologist, U.S.G.S., Sacramento, CA 2009-Present

- Development and application of wetland accretion model to SF Bay wetlands
- SSC sampling and analysis within SF Bay wetlands
- Collection and synthesis to wetland datasets to inform wetland modeling

Hydrologist, U.S.G.S., Sacramento, CA 2003, 2004

- Analysis of chemical, hydrological and physical changes in Napa Salt Pond 3 following breaching
- Science support for salt pond restoration

Ph.D. Student, University of California, Berkeley 2003-2011

- Chemical and physical analysis of sediment including ICP-AES and GF techniques
- ADCP operation and data analysis
- Numerical modeling using Matlab

NSF Research Experience for Undergraduates, University of Oklahoma 2001

- Field research investigating hydrology of a wetland in the Tar Creek Superfund Site
- Developed remediation proposal to treat mine discharge and reclaim contaminated sediment

(C) Selected publications and presentations

Swanson, K. M., E. Watson, R. Aalto, J. W. Lauer, M. T. Bera, A. Marshall, M. P. Taylor, S. C. Apte, and W. E. Dietrich (2008), Sediment load and floodplain deposition rates: Comparison of the Fly and Strickland rivers, Papua New Guinea, J. Geophys. Res., 113, F01S03.

Shellenbarger, G.G., K.M. Swanson, D.H. Schoellhamer, J.Y. Takekawa, N.D. Athearn, A.K. Miles, S.E. Spring, and M.K. Saiki. Desalination, erosion, and tidal and ecological changes following the breaching of a levee between a salt pond and a tidal slough. Wetlands, In Prep.

Swanson, K.M., M.T. Stacey, and W.E. Dietrich. Modeling the pattern of deposition on a large lowland river floodplain: Lessons from the Fly and Strickland Rivers, PNG. Geomorphology. In Prep.

Swanson, K.M., J.Z. Drexler, D.H. Schoellhamer, K. Thorne, K. Spragens and J.Takekawa (2010), Sensitivity analysis of the Wetland Accretion Rate Model for Ecosystem Resilience (WARMER), Poster, American Geophysical Union, San Francisco, CA. December 13-17.

Swanson, K.M., J.Z. Drexler, D.H. Schoellhamer, K. Thorne, K. Spragens and J.Takekawa (2010), Integrating biological and physical models to predict the impact of sea-level rise on tidal marsh habitat, Poster, Bay Delta Science Conference, Sacramento, CA. September 27 – 29

Swanson, K.M., M.T. Bera, and W.E. Dietrich (2005), Velocity profiles and turbulent structure over the sand bed of the lower Strickland River, Papua New Guinea, Poster, American Geophysical Union, San Francisco, December 5-9.

Swanson, K.M., G.G. Shellenbarger, D.H. Schoellhamer, N.K. Ganju, N. Athearn, and P. Buchanan (2003), Desalinization, erosion, and tidal changes following the breaching of Napa salt pond 3, Poster, The 6th biennial State-of-the-Estuary Conference, Oakland, California, October 21-23.

Awards and Fellowships

Environmental Engineering Master's Fellowship, University of California, Berkeley 2002-2003

Professional Credentials

Engineer In Training (EIT) Certification